SERVICE MANUAL SQA-2

marantz

model SQA-2

SQ ADAPTOR

marantz

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1. INTRODUCTION

This service manual was prepared for use by Authorized Warranty Stations and contains service information for Marantz Model SQA-2 SQ Adaptor.

Servicing information and voltage data included in this manual are intended for use by the knowledgeable and experienced technician only. All instruction should be read carefully. No attempt should be made to proceed without a good understanding of the operation in the circuits.

The parts lists furnish information by which replacement parts may be ordered from the Marantz Company. A simple description is included for parts which can usually be obtained through local suppliers.

2. SERVICE NOTES

The Model SQA-2 Decoder reproduces four channel sounds from phonograph records processed by Columbia's stereo-quadraphonic encoding system. (CBS SQ System). In this system the SQ record is produced by mixing 4-channel stereophonic sound signals from a 4-channel master tape into a 2-channel signal through a matrix encoder. When the record is played on a regular stereophonic player excellent stereo sound is obtained. When the SQ record is played back by a 4-channel playback system with the SQ decoder, the resulting 4-channel sound is virtually indistinguishable from the original master tape. The recorded sound can be broadcasted through the FM multiplex system and decoded into 4-channel sound through a receiver equipped with an SQ decoder.

The Model SQA-2 includes the front-back logic and the corner logic circuits which enhance interchannel separation.

The Model SQA-2 is specifically designed for plug-in use with Marantz 4-channel audio components (Models 4415, 4430, 4100, 4060, 2440, etc.). The adaptor is easily installed on the underside of the master unit. It should be noted that the Model SQA-2 is specifically designed for certain Marantz 4-channel components only. Marantz is not responsible for any damage resulting from any attempt to connect the SQA-2 to any audio component for which the SQA-2 was not specifically designed.

3. CIRCUIT DESCRIPTION

Symbols L_T and R_T employed here indicate the SQ encoded Left Total and Right Total 2-channel input signals, respectively. These 2-channel signals are decoded into 4-channel signals; LF (Left Front), RF (Right Front), LB (Left Back) and RB (Right Back). As it can be seen in Figure 1, the Model SQA-2 circuit comprises the basic SQ decoder. Front-Back and corner logic circuits, gain control circuit and output amplifiers.

3.1 Basic SQ Decoder

The basic decoder consists of the IC H501 (CX-050) and phase shift networks (R507 thru R526, C507 thru C520). The H501, CX-050 is the IC expressly designed to decode the matrixed 4-channel signals. L_T and R_T signals are fed to pins 13 and 16 of the CX-050 and the decoded 4 channel signals are obtained from pins 3, 4, 6 and 7. The gain of the CX-050 is unity. However, the input signals are attenuated by about 4.5dB when they go through attenuators (R501, 503, 505)/(R502, 504, 506) included in the input circuit, therefore the overall output levels at the H501 output circuit are 4.5dB lower than those of the input circuit. The attenuators are inserted to improve the signal overload characteristics. The RC networks inserted between pins 12, 10 and 11 (and also between pins 17,1 and 18) of the CX-050 are the phase-shifters designed to produce 90 degrees of phase difference between the signals applied to PIN 10 (PIN 1) and PIN 11 (PIN 18). The characteristics of the phase shifters are such that maintain a 90 ± 10 degrees phase shift from 30Hz to 20KHz.

3.2 Front-Back And Corner Logic

The H502, CX-049 is the IC expressly designed to generate the SQ logic signals. The output signals from the basic decoder are fed to the input terminals PIN 3, PIN 4, PIN 6 and PIN 7 of the CX-049 through the emitter followers (H523 thru H526) provided to improve the output linearity of H501 which is followed by the relatively low input impedance (about 1K ohm) of H502. The values of the input coupling capacitors (C528 thru C531) are selected to have a relatively small time constant to prevent low frequency signal from entering into the H502 and to improve the operation stability of the H502.

The CX-049 contains two logic circuits. One produces a control signal when the predominant content of the input is at or near the CF or CB locations. It is called front-back logic and its outputs are taken from Pin 21 for the front signals and Pin 24 for the back signals. The second circuit generates control signals whenever the input sounds are located around one of the four corners, LF, RF, LB or RB. This is the corner logic or wave matching logic whose outputs are derived from Pins 19 and 16 for the front and back controlled circuits respectively.

The control signals for the front and back channels, are taken from differential amplifier outputs so that they increase or decrease the gain of those channels in a complimentary fashion. The level of the differential control signals at the outputs of the H502 is about 4.5V. These signals are conveyed thru diodes H510 to H517 to eliminate undesired side lobe responses and thru circuits having the proper time constants for a smooth logic action.

The final control signals are formed by combining the outputs of the front-back logic and corner logic for the front and back channels respectively.

3.3 Gain Control Circuit

The gain control circuit consists of the H503 and R557 thru R560. In the IC H503, four FETs are packaged and they are operated as voltage controlled variable resistors forming attenuator pads with resistors, R557 thru R560. The LF and RF channels are controlled as a pair and the LB and RB channels are also controlled as another pair. The source terminals (PIN 4, PIN 7, PIN 11) of the FET elements in the H503 are biased about +1.5V with respect to the gate potential and the bias voltages are set in such a way that when the logic circuit lowers the gain of the undesired channels, the gain of the desired channels is increased by about 3dB. This bias setting is performed by adjusting R586. The control signals applied to each of the FET gates (PIN 3, PIN 8, PIN 12) will swing positive or negative from the reference voltage (about +10V) at the PIN 1 of the H502.

3.4 Output Amplifier

Once the signals have attained its final separation within the H503 they are boosted by about 4.5dB, equal amount of the loss caused in the input circuits, by means of the output amplifiers consisting of H504 thru H507. The C560 thru C563 are capacitors provided for noise reduction.

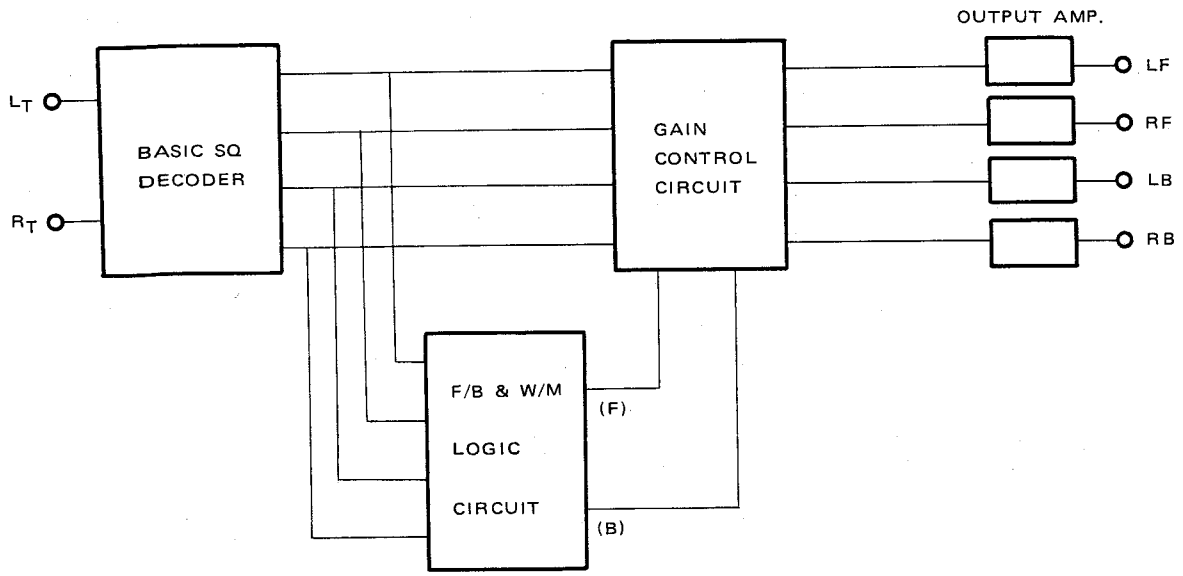


Figure 1 Model SQA-2 Full Logic SQ Decoder Block Diagram

INPUT			OUTPUT				
1KHz (0 dB=150mV)				LF	RF	LB	RB
LF	LT only	150mV	dB	0±1.5	≤-20	-3±1.5	-3±1.5
RF	RT only	150mV	dB	≤-20	0±1.5	-3±1.5	-3±1.5
LB	LT=RT (-90°)	106mV	dB	-3±1.5	-3±1.5	0±1.5	≤-20
RB	LT=RT (+90°)	106mV	dB	-3±1.5	-3±1.5	≤-20	0±1.5
CF	LT=RT	150mV	dB	0±1.5	0±1.5	0±1.5	0±1.5
CB	LT=-RT	150mV	dB	0±1.5	0±1.5	0±1.5	0±1.5

Note. LT=RT (-90°) indicates that LT signal leads RT signal by 90 degree in phase relationship.

Table 1. SQ Basic Decoder Characteristics

INPUT			OUTPUT				
1KHz (0dB=150mV)				LF	RF	LB	RB
LF	LT only	150mV	dB	0±1.5	≤ -20	≤ -12	≤ -12
RF	RT only	150mV	dB	≤ -20	0±1.5	≤ -12	≤ -12
LB	LT=RT (-90°)	106mV	dB	≤ -12	≤ -12	0±1.5	≤ -20
RB	LT=RT (+90°)	106mV	dB	≤ -12	≤ -12	≤ -20	0±1.5
CF	LT=RT	150mV	dB	0±1.5	0±1.5	≤ -12	≤ -12
CB	LT=-RT	150mV	dB	≤ -12	≤ -12	0±1.5	0±1.5

Table 2. Logic Characteristics

PIN No.	DC Volts (V)
1	13.5
2	12.3
3	12.3
4	12.3
5	12.3
6	12.3
7	12.3
8	20.0
9	12.3
10	13.5
11	13.5
12	12.3
13	13.5
14	14.1
15	13.5
16	13.5
17	12.5
18	13.5
19	0

Table 3.
H501 CX-050
Quiescent DC Voltages

PIN No.	DC Volts (V)
1	10.0
2	—
3	10.0
4	10.0
5	0
6	10.0
7	10.0
8	—
9	—
10	—
11	15.6
12	15.6
13	15.6
14	15.6
15	—
16	10.0
17	10.0
18	10.0
19	10.0
20	20.0
21	10.0
22	10.0
23	10.0
24	10.0
25	0

Table 4.
H502 CX-049
Quiescent DC Voltages

PIN No.	DC Volts (V)
1	11.5
2	10.0
3	10.0
4	11.5
5	11.5
6	10.0
7	11.5
8	10.0
9	10.0
10	11.5
11	11.5
12	10.0
13	10.0
14	11.5
15	17.5

Table 5.
H503 CX-718
Quiescent DC Voltages

NOTE: DC voltages measured with respect to ground.

4. TROUBLE ANALYSIS

First check the total current drain, which should be approximately 83mA under normal operating condition. For easy and quick trouble shooting, it is advisable to check each functional section of the SQ basic decoder, F/B and corner logic circuit, gain control circuit and output amplifiers.

4.1 SQ Basic Decoder And Output Amplifier

Stop the operation of the logic circuit by directly connecting the PIN 3 (PIN 12), PIN 8 and PIN 4 (PIN 7 and PIN 11) of the H503 to the PIN 1 (+10V line) of the H502.

Check each channel output voltage according to Table 1. If the results are same as the values in Table 1, there should be no trouble in the H501 SQ Basic Decoder and the output amplifiers (H504 thru H507). If the results are different from those in Table 1, check the H501 output voltages. The output voltages should be about 4.5dB lower than the values in the Table 1 for normal operation of the SQ Basic Decoder. When there is an abnormal output in the H501, check each terminal DC voltages of the H501 and phase-shift networks. (refer to Table 3)

When the output of the H501 is normal but an abnormal condition is found in the decoder outputs, check R557-R560 and signals at the four connecting points of the H503. If the signals at these points are almost the same as the outputs of H501, there should be some defects(s) in the H504-H507 output amplifiers. Then, check collector voltages of the H504 thru H507, they should be 7 to 10V when biased correctly.

4.2 Front Back And Corner Logic Circuit

If there is no problem when the logic operation is stopped as stated in the 4.1, check the H502 and H523 thru H526. Each voltage at the PIN 16, PIN 19, PIN 21 and PIN 24 of the H502 should be kept within ±0.6V from the voltage at PIN 1 at no signal condition. If the voltages at no signal condition are correct, check each output of the H502 by injecting the encoded signal of 1KHz, 150mV. The voltage at the PIN 16 will fall for both LF and RF input signals but will rise for both LB and RB input signals applied. The voltage at the PIN 19 will change in an opposite direction.

The voltage at the PIN 21 will rise for CF input and fall for CB input. The voltage at the PIN 24 will change in an opposite direction.

5. H503 Bias Adjustment

1. Feed 1KHz, 150mV, LF encoded signal. [LT=150mV, RT=0]
2. Temporarily short or open-circuit the H503 PIN 8 to the H502 PIN 1 and observe the voltage change at the LF channel output.
   Adjust R586 so that a voltage change of 3 to 3.5dB is obtained.

6. Test Equipment Required for Servicing

Table 6 lists the test equipment required for servicing the Model SQA-2 SQ Adaptor.

ITEM	Manufacturer & Model No. (or equivalent)	USE
Distortion Analyzer	Hewlet Packard, Model 331A or 333A	Measures distortion and output signal level
Audio Oscillator	Krohn-Hite 4000A*	Sinewave signal source
VTVM	RCA Senior Volt-Ohmyst Model WV-98C	Voltage and resistance measurements
Oscilloscope	Tektronix, Model 503, Data, Model 555	Waveform analysis and trouble shooting
Regulated DC Power Supply (35V 0.5A)		Power source
DC Voltmeter (0–50V)	Commercial Grade	Line voltage measurement
DC Ammeter (0–100mA)	Commercial Grade	Current drain measurement
Output Load Resistor (100K ohm ±0.5% 1/2W)	Commercial Grade	Output termination
SQ Encoder		Signal encoding
Phase Meter		Signal phase measurement

Table 6. Test Equipment Required for Servicing

* The audio oscillator used must have quadrature (90° out of phase) output in order to generate the LB and RB signals.

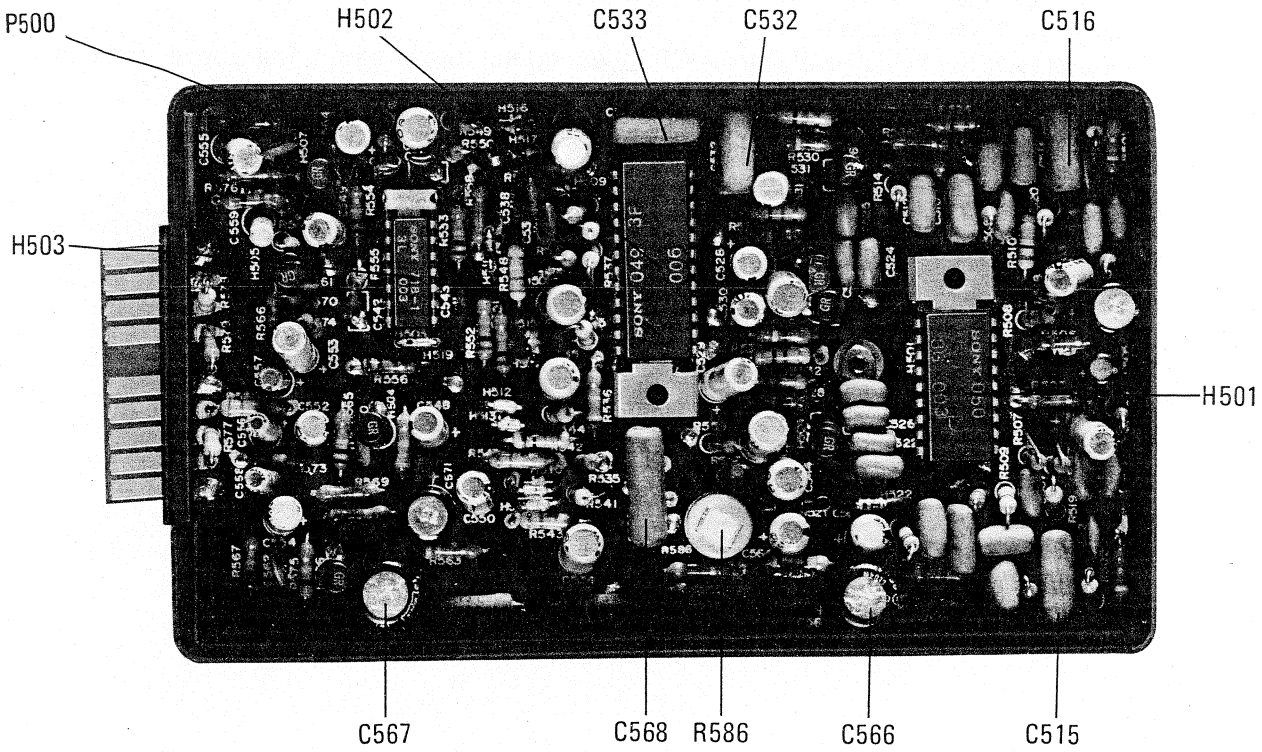
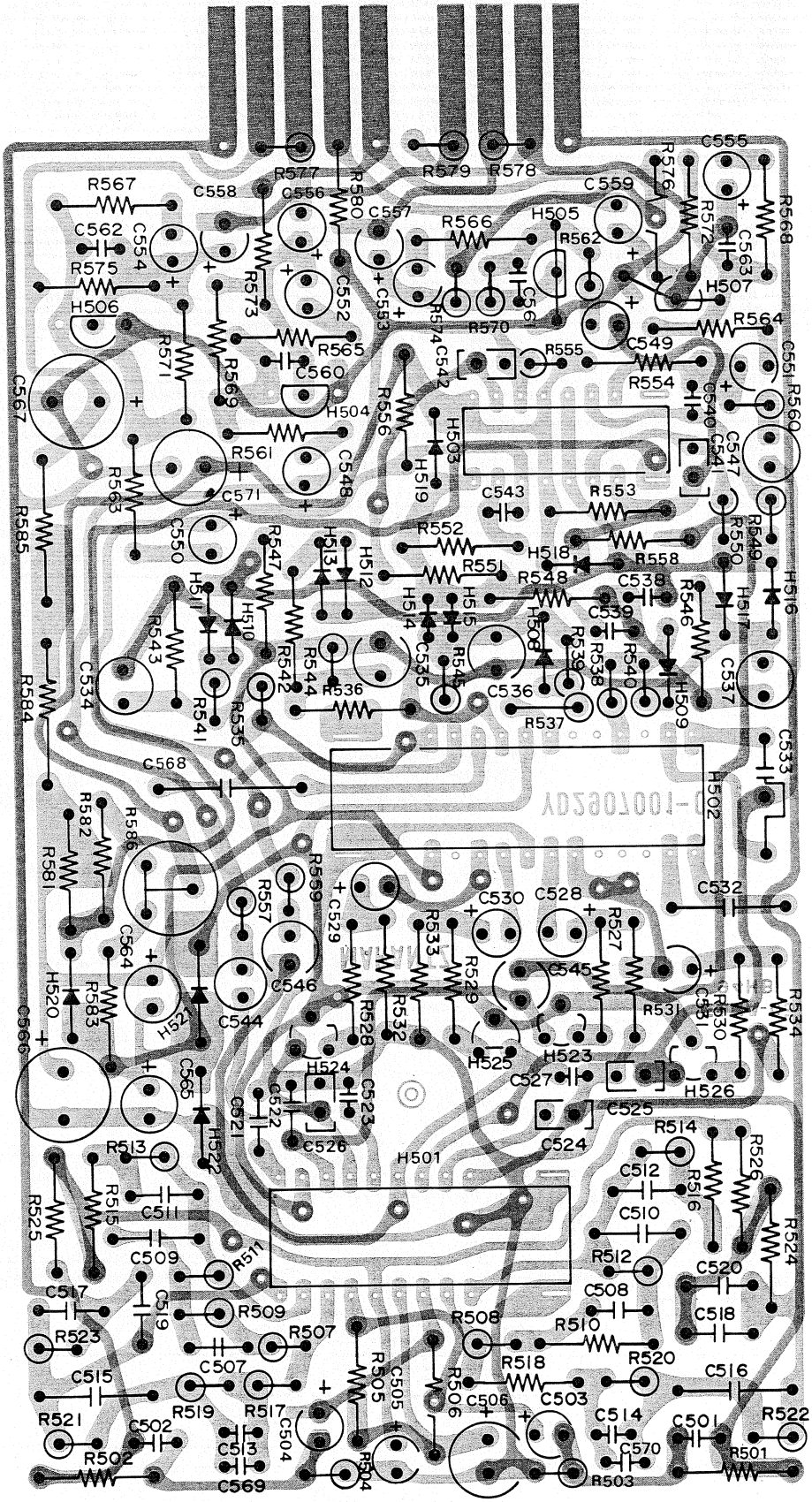


Figure 2. Component Locations (Top View)


R567
C558
R577
C556
R580
C557
R579
R578
C559
C555
R576
R572
C563
R568
C562
C554
R575
H506
R573
C552
C553
R566
H505
R562
C561
H507
R574
C542
R570
R564
R565
C560
R571
R569
R556
R555
C549
C551
R560
C567
H504
R561
C548
H503
H519
C540
C541
C547
R563
C571
C543
R553
R585
C550
R552
R549
R550
H516
H518
R558
R551
R548
C538
H517
H513
H512
H514
H515
H508
C539
R546
C537
R547
H511
H510
R543
R542
R544
C535
R545
R539
R538
R540
H509
C536
R536
R537
C534
R541
R535
C533
C568
H502
R582
R586
R581
R559
C529
C530
C528
C532
R557
C546
R533
R529
R527
C545
R534
C564
R583
H520
H521
C544
R528
R532
C531
R530
C566
H524
H525
H523
C527
H526
C523
C522
C521
C526
C525
C524
R514
R526
H501
C512
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C565
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R506
R518
C516
C515
R519
R517
C506
C503
C514
C501
R522
R521
C502
C504
C513
C570
R501
R502
C569
R504
R503

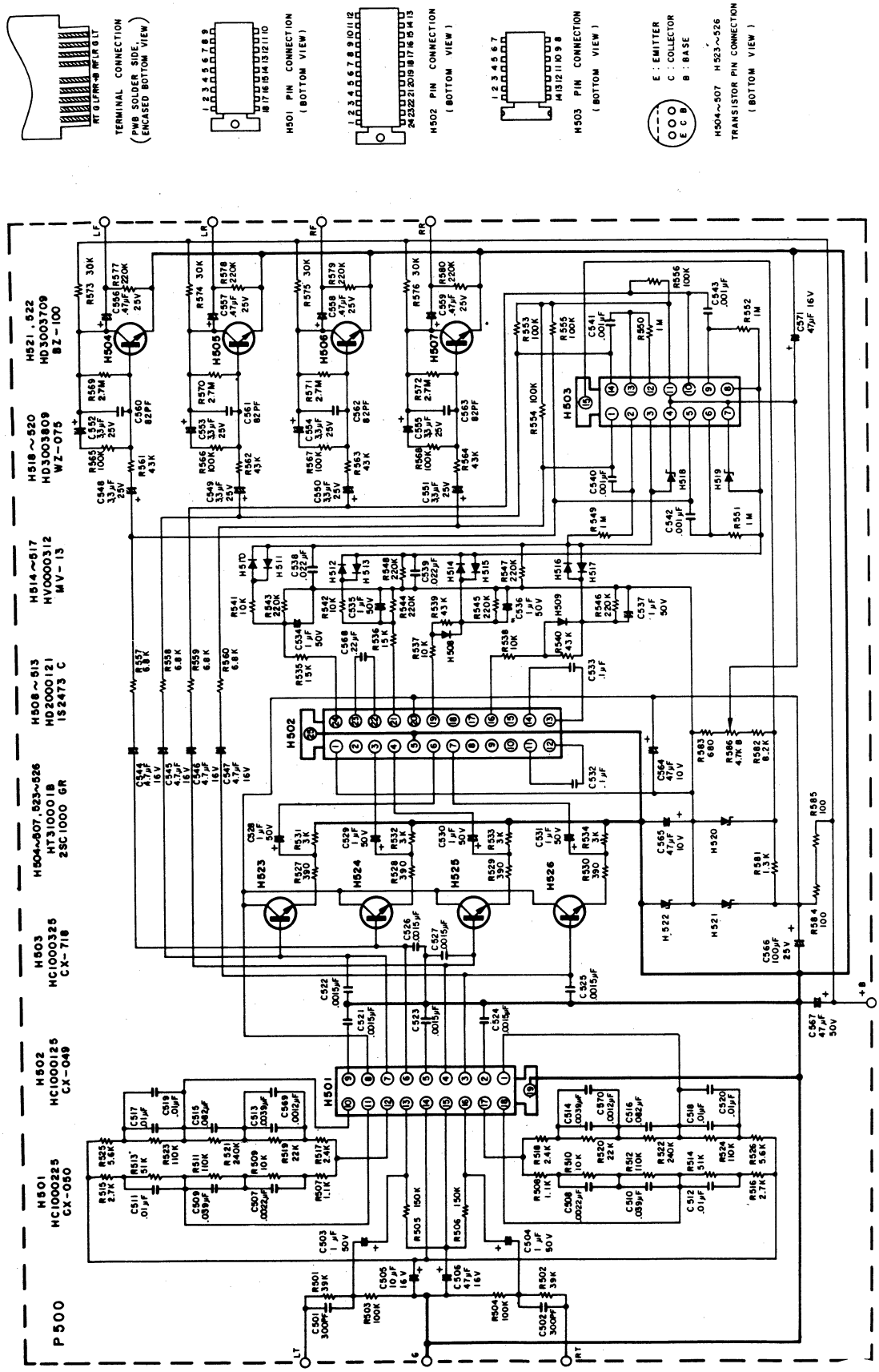

Figure 4. Schematic Diagram

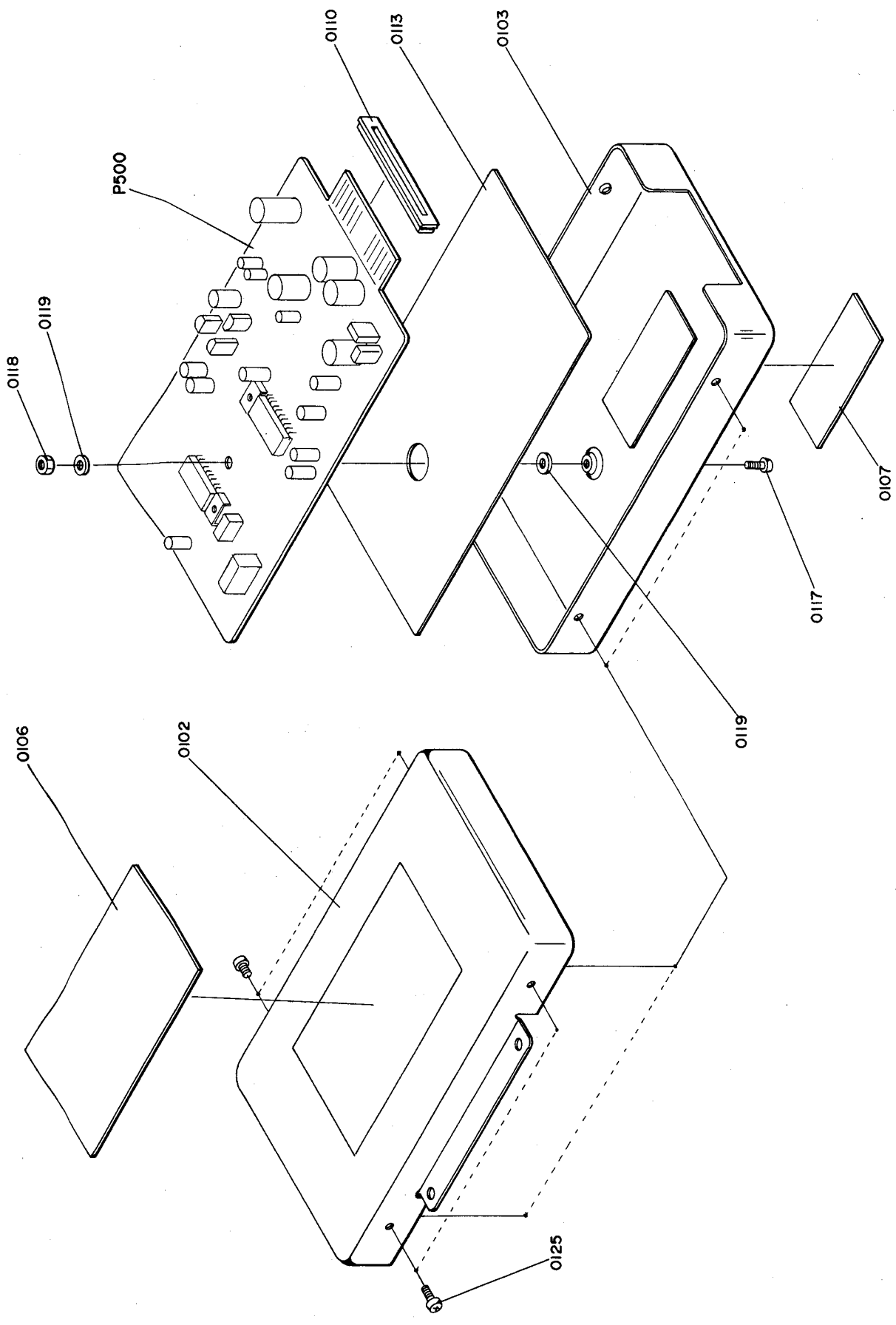

Figure 5. Exploded Mechanical Diagram

PARTS LIST

REF. DESIG.	MARANTZ PART NO.	DESCRIPTION
P500	YD2907001	P. W. Board (Print Only) Full Logic SQ Decoder
	ZZ2907001	P.W. Board Assembly
		P500 RESISTORS All resistors are ±5% and ¼W, unless otherwise indicated.
R501	RT0539314	39KΩ
R502	RT0539314	39KΩ
R503	RT0510414	100KΩ
R504	RT0510414	100KΩ
R505	RT0515414	150KΩ
R506	RT0515414	150KΩ
R507	RT0511214	1.1KΩ
R508	RT0511214	1.1KΩ
R509	RT0510314	10KΩ
R510	RT0510314	10KΩ
R511	RT0511414	110KΩ
R512	RT0511414	110KΩ
R513	RT0551314	51KΩ
R514	RT0551314	51KΩ
R515	RT0527214	2.7KΩ
R516	RT0527214	2.7KΩ
R517	RT0524214	2.4KΩ
R518	RT0524214	2.4KΩ
R519	RT0522314	22KΩ
R520	RT0522314	22KΩ
R521	RT0524414	240KΩ
R522	RT0524414	240KΩ
R523	RT0511414	110KΩ
R524	RT0511414	110KΩ
R525	RT0556214	5.6KΩ
R526	RT0556214	5.6KΩ
R527	RT0539114	390Ω
R528	RT0539114	390Ω
R529	RT0539114	390Ω
R530	RT0539114	390Ω
		Ω
R531	RT0530214	3KΩ
R532	RT0530214	3KΩ
R533	RT0530214	3KΩ
R534	RT0530214	3KΩ
R535	RT0515314	15KΩ
R536	RT0515314	15KΩ
R537	RT0510314	10KΩ
R538	RT0510314	10KΩ
R539	RT0543314	43KΩ
R540	RT0543314	43KΩ
R541	RT0510314	10KΩ
R542	RT0510314	10KΩ
R543	RT0522414	220KΩ
R544	RT0522414	220KΩ
R545	RT0522414	220KΩ
R546	RT0522414	220KΩ

REF. DESIG.	MARANTZ PART NO.	DESCRIPTION
R547	RT0522414	220KΩ
R548	RT0522414	220KΩ
R549	RT0510514	1MΩ
R550	RT0510514	1MΩ
R551	RT0510514	1MΩ
R552	RT0510514	1MΩ
R553	RT0510414	100KΩ
R554	RT0510414	100KΩ
R555	RT0510414	100KΩ
R556	RT0510414	100KΩ
R557	RT0568214	6.8KΩ
R558	RT0568214	6.8KΩ
R559	RT0568214	6.8KΩ
R560	RT0568214	6.8KΩ
R561	RT0543314	43KΩ
R562	RT0543314	43KΩ
R563	RT0543314	43KΩ
R564	RT0543314	43KΩ
R565	RT0510414	100KΩ
R566	RT0510414	100KΩ
R567	RT0510414	100KΩ
R568	RT0510414	100KΩ
R569	RT0527514	2.7MΩ
R570	RT0527514	2.7MΩ
R571	RT0527514	2.7MΩ
R572	RT0527514	2.7MΩ
R573	RT0530314	30KΩ
R574	RT0530314	30KΩ
R575	RT0530314	30KΩ
R576	RT0530314	30KΩ
R577	RT0522414	220KΩ
R578	RT0522414	220KΩ
R579	RT0522414	220KΩ
R580	RT0522414	220KΩ
R581	RT0513214	1.3KΩ
R582	RT0582214	8.2KΩ
R583	RT0568114	680Ω
R584	GJ0510101	100Ω
R585	GJ0510101	100Ω ±5% 1W
R586	RA0502013	Trimming 4.7KΩ B ¼W
		P500 CAPACITORS
C501	DD1530102	Ceramic 300pF ±5% 50V
C502	DD1530102	Ceramic 300pF ±5% 50V
C503	EE1050501	Electroly 1μF ±20% 50V
C504	EE1050501	Electroly 1μF ±20% 50V
C505	EA1060169	Electroly 10μF $^{+100}_{-10}$% 16V
C506	EA4760169	Electroly 47μF
C507	DF1522205	Film 0.0022μF ±5% 50V
C508	DF1522205	Film 0.0022μF ±5% 50V
C509	DF1539305	Film 0.39μF ±5% 50V

REF. DESIG.	MARANTZ PART NO.	DESCRIPTION
C510	DF1539305	Film 0.39μF ±5% 50V
C511	DF1510305	Film 0.01μF ±5% 50V
C512	DF1510305	Film 0.01μF ±5% 50V
C513	DF1539201	Film 0.0039μF ±5% 50V
C514	DF1539201	Film 0.0039μF ±5% 50V
C515	DF1582305	Film 0.82μF ±5% 50V
C516	DF1582305	Film 0.82μF ±5% 50V
C517	DF1510305	Film 0.01μF ±5% 50V
C518	DF1510305	Film 0.01μF ±5% 50V
C519	DF1510305	Film 0.01μF ±5% 50V
C520	DF1510305	Film 0.01μF ±5% 50V
C521	DF1515205	Film 0.0015μF ±5% 50V
C522	DF1515205	Film 0.0015μF ±5% 50V
C523	DF1515201	Film 0.0015μF ±5% 50V
C524	DF1515201	Film 0.0015μF ±5% 50V
C525	DF1515201	Film 0.0015μF ±5% 50V
C526	DF1515201	Film 0.0015μF ±5% 50V
C527	DF1515201	Film 0.0015μF ±5% 50V
C528	EE1050501	Electroly 1μF ±20% 50V
C529	EE1050501	Electroly 1μF ±20% 50V
C530	EE1050501	Electroly 1μF ±20% 50V
C531	EE1050501	Electroly 1μF ±20% 50V
C532	DF1510405	Film 1μF ±5% 50V
C533	DF1510405	Film 1μF ±5% 50V
C534	EQ1050501	Electroly 1μF ±20% 50V
C535	EQ1050501	Electroly 1μF ±20% 50V
C536	EQ1050501	Electroly 1μF ±20% 50V
C537	EQ1050501	Electroly 1μF ±20% 50V
C538	DF1622301	Film 0.022μF ±10% 50V
C539	DF1622301	Film 0.022μF ±10% 50V
C540	DF1610201	Film 0.001μF ±10% 50V
C541	DF1610201	Film 0.001μF ±10% 50V
C542	DF1610201	Film 0.001μF ±10% 50V
C543	DF1610201	Film 0.001μF ±10% 50V
C544	EQ4750161	Electroly 4.7μF ±30% 16V
C545	EQ4750161	Electroly 4.7μF ±30% 16V
C546	EQ4750161	Electroly 4.7μF ±30% 16V
C547	EQ4750161	Electroly 4.7μF ±30% 16V
C548	EE3350251	Electroly 3.3μF ±20% 25V
C549	EE3350251	Electroly 3.3μF ±20% 25V
C550	EE3350251	Electroly 3.3μF ±20% 25V
C551	EE3350251	Electroly 3.3μF ±20% 25V
C552	EE3350251	Electroly 3.3μF ±20% 25V
C553	EE3350251	Electroly 3.3μF ±20% 25V
C554	EE3350251	Electroly 3.3μF ±20% 25V
C555	EE3350251	Electroly 3.3μF ±20% 25V
C556	EM4740252	Electroly 0.47μF $^{+30}_{-10}$% 25V
C557	EM4740252	Electroly 0.47μF $^{+30}_{-10}$% 25V

REF. DESIG.	MARANTZ PART NO.	DESCRIPTION
C558	EM4740252	Electroly 0.47μF $^{+30}_{-10}$% 25V
C559	EM4740252	Electroly 0.47μF $^{+30}_{-10}$% 25V
C560	DD1582001	Ceramic 82pF ±5% 50V
C561	DD1582001	Ceramic 82pF ±5% 50V
C562	DD1582001	Ceramic 82pF ±5% 50V
C563	DD1582001	Ceramic 82pF ±5% 50V
C564	EA4760109	Electroly 47μF $^{+100}_{-10}$% 10V
C565	EA4760109	Electroly 47μF $^{+100}_{-10}$% 10V
C566	EA1070259	Electroly 100μF $^{+100}_{-10}$% 25V
C567	EA4760509	Electroly 47μF $^{+100}_{-10}$% 50V
C568	BF1622405	Film 0.22μF ±10% 50V
C569	DF1512201	Film 0.0012μF ±5% 50V
C570	DF1512201	Film 0.0012μF ±5% 50V
C571	EA4760169	Electroly 470μF $^{+100}_{-10}$% 16V
		P500 SEMICONDUCTORS
H501	HC1000225	IC CX-050
H502	HC1000125	IC CX-049
H503	HC1000325	IC CX-718
H504	HT310001B	Transistor 2SC1000 (GR)
H505	HT310001B	Transistor 2SC1000 (GR)
H506	HT310001B	Transistor 2SC1000 (GR)
H507	HT310001B	Transistor 2SC1000 (GR)
H508	HD2000121	Diod 1S2473 (C)
H509	HD2000121	Diod 1S2473 (C)
H510	HD2000121	Diod 1S2473 (C)
H511	HD2000121	Diod 1S2473 (C)
H512	HD2000121	Diod 1S2473 (C)
H513	HD2000121	Diod 1S2473 (C)
H514	HV0000312	Varistor MV-13
H515	HV0000312	Varistor MV-13
H516	HV0000312	Varistor MV-13
H517	HV0000312	Varistor MV-13
H518	HD3003809	Diode WZ-075
H519	HD3003809	Diode WZ-075
H520	HD3003809	Diode WZ-075
H521	HD3003709	Diode BZ-100
H522	HD3003709	Diode BZ-100
H523	HT310001B	Transistor 2SC1000 (GR)
H524	HT310001B	Transistor 2SC1000 (GR)
H525	HT310001B	Transistor 2SC1000 (GR)
H526	HT310001B	Transistor 2SC1000 (GR)

REF. DESIG.	MARANTZ PART NO.	DESCRIPTION
		GENERAL MISCELLANEOUS
0102	285706401	Case (Upper)
0106	290720301	Name Plate "Marantz" (Upper)
0103	285706402	Case (Bottom)
0113	288312003	Insulator Inside Case
0107	290726501	Indicator Name Plate (Bottom
0110	285725901	Bush
0117	51100308S	B.H.M Screw B3x8
0118	53110303E	Hexagon Nut
0119	59030808P	Washer x 2
0125	51102604S	B.H.M Screw x 4 B2.6x4 For fitting Case

REF. DESIG.	MARANTZ PART NO.	DESCRIPTION
0202	290785121	Instructions
0208	952281501	Serial No. Card x 3
0211	290780250	Display Box K
0215	290780501	Master Carton
0216	290780101	Packing Case
0219	901201801	Polyethylen Bag For Set and Printed Matter

7. TECHNICAL SPECIFICATIONS

Frequency Response (40Hz-20KHz) ..... ±2dB
Total Harmonic Distortion at 1KHz 300mV Input ..... ≥0.2%
Separation (1KHz 300mV Input)
- LF, RF – LR, RR ..... ≥12dB
- CF – CB ..... ≥12dB
- LF – RF ..... ≥20dB
- LR – RR ..... ≥20dB

Hum and Noise ..... ≤0.55mV
Maximum Input Voltage ..... ≥4.5V

GENERAL

Current Drain at No Signal ..... ≤90mA
Dimensions
- Width ..... 6-5/16" 161mm
- Height ..... 1-1/16" 29mm
- Depth ..... 4-3/8" 111mm

Weight 0.6lbs 0.3Kg